jective prisms attached, and have been checked by observations with the large reflectors. Half of those listed are known nebulae. The criteria applied in such cases are as follows: (1) Predominantly bright-line spectrum, (2) symmetrical form, (3) about a central star, (4) well defined border. The last two items are questionable in the case of N.G.C. 2818, and the last in I.C. 1470, but the appearance of both these nebulae on direct photographs made with the 100-inch and 60-inch reflectors approximates the planetary more closely than any other recognized nebular form. I.C. 1470 and N.G.C. 7635 may possibly be transition forms between planetaries and diffuse gaseous nebulae.

Six of the objects have not previously been listed as nebulae. These are all small, rather faint nebulae in which central stars could not be seen with the large reflectors. Positions are given for 1920. Photographic magnitudes are estimated for central stars or, in the case of small objects in which no stars can be seen, a magnitude is given in brackets for the nebula as a whole. Measured photovisual magnitudes are given for Nos. 10 and 11.

Two New Planetary Nebulae

Two objects have been identified as planetary nebulae from spectrograms made with the 10-inch Cooke telescope and 6° objective prism.

No.	R.A. 1920	Dec. 1920	Size	Mag.	Bright Lines	Date of Observation
1	$0^h23^m.9$	$+55°28'$	$5''$	13.0	N_1, N_2 about equal	1920 Nov. 9
2	21 29 .9	+39 16	$5''$	12.5	$N_1(5)$, $N_2(1)$, $H\beta(3)$, $H\gamma(2)$	1920 Oct. 11

Mr. Hubble observed both objects visually with the 60-inch reflector on December 9, 1920. Each appeared as a small disk about $5''$ in diameter, the first being irregular in outline, the second nearly circular.

M. L. Humason.

The Leading Features of the Electric Furnace Spectrum of Scandium

In this study, about 300 lines of scandium, between λ3000 and λ6600, were photographed at various temperatures of the electric

LIST OF NEBULAE

No.	Object	R.A. 1920	Dec. 1920	Size	Mag. of Central Star	Lines and Intensities	Date of Observation
1	I.C. 289	$3^h\ 3^m.9$	$+61°\ 2'$	$45'' \times 30''$	15	N_1+N_2	1920 Oct. 9
2	N.G.C. 2818	9 13 .0	−36 17	$40''$	.....	$N_1+N_2+H\beta(3)$, $H\gamma(1)$	1921 Mar. 2
3	N.G.C. 6072	16 7 .7	−36 2	$50'' \times 30''$	17.5	$N_1+N_2(3)$, $H\beta(1)$, $H\gamma(1)$	1920 July 16
4	.....	17 37 .0	−24 39	$5''$	(13)	$N_1+N_2(3)$, $H\beta(1)$	1920 June 19
5	C.D.−29°.13998	17 42 .9	−29 55	$3''$	(12)	$N_1+N_2(5)$, $H\beta(1)$, $H\gamma(1)$	1920 June 19
6	.....	17 50 .4	−21 44	$5''$	(13)	$N_1+N_2(3)$, $H\beta(1)$	1920 June 19
7	C.D.−32°.14673	18 50 .0	−32 22	$4''$	(11.5)	$N_1+N_2(4)$, $H\beta(1)$, $H\gamma(1)$	1920 June 16
8	.....	19 0 .0	−33 17	$5''$	(13)	N_1+N_2	1920 June 16
9	N.G.C. 7048	21 11 .4	+45 57	$60''$	18	N_1+N_2	1920 Sept. 17
10	I.C. 1470	23 1 .9	+59 49	$70'' \times 45''$	12.1	$N_1(2)$, $N_2(1)$, $H\beta(4)$, 4686(1), $H\gamma(3)$, $H\delta(2)$	1920 Aug. 14
11	N.G.C. 7635	23 17 .2	+60 45	$180'' \times 205''$	8.7	$H\beta(4)$, $H\gamma(2)$, $H\delta(1)$, 3727(4)	1920 Nov. 13
12	.....	23 22 .0	+57 45	10″ or less	.....	$N_1+N_2(5)$, $H\beta(3)$, $H\gamma(4)$, $H\delta(1)$, $H\epsilon(1)$	1920 Aug. 14

NOTES.

1. Ring Nebula, Axis NW-SE.
2. Knox Shaw decides against the planetary character, but predicts a gaseous spectrum. (*Helwan Bul.*, No. 9). A direct photograph with the 100-inch reflector shows a rough resemblance to M 27 or N.G.C. 7048, but with no central star. λ3727 is suspected on the objective prism plates.
3. Direct photographs show an irregular dumbbell figure.

4., 5, 6, 7, 8. No central star could be seen with the reflectors. Magnitudes refer to nebula as a whole.

9. Dumbbell form. Described as a planetary from its form by Pease. (*Ap. Jour.*, **51**, 276).
10. Gaseous spectrum predicted by Pease (*Ap. Jour.*, **51**, 276), who gives a photograph of the object. Magnitude of the star is photovisual. Its spectrum is earlier than Bo with no emission lines.
11. The principal star is eccentrically located in a distorted shell which lies on a background of faint, diffuse nebulosity. The spectrum of the star (B.D. +60° 2522) is similar to that of *ζ Puppis* with the bright lines suppressed. Radial velocity from three plates, uncorrected for solar motion, is −35 km. Magnitude is photovisual.

Mt. Wilson Observatory. EDWIN HUBBLE.

furnace, and classified according to the temperature at which they appear and their response to increase of temperature.

Many scandium lines, notably a large group in the red, show high intensity at the lowest temperature stage used, 1900°-2000° C, some maintaining their strength and others weakening at higher temperatures. The majority, however, develop distinctly at about 2250° and strengthen rapidly as the temperature rises. Numerous cases are found of strong furnace lines which are relatively weak in the arc.

The enhanced lines, which are prominent in the scandium arc as well as in the spark, are of special interest in connection with the solar spectrum, since these are for the most part the lines which identify scandium in the Sun. In the furnace, many of the stronger enhanced lines appear, some of them at the medium temperature of 2250° C used in these experiments. This places the scandium enhanced lines in an intermediate position, as regards the excitation required to produce them, between those of titanium and those of the type of H and K of calcium, the latter appearing at still lower furnace temperatures.

The low-temperature lines of scandium in general appear with considerable strength in sun-spot spectra, tho faint or absent in the spectrum of the disk. Fowler noted a number of lines of this kind, which he produced in the flame of the arc, and the furnace adds to these some strong low-temperature lines which are faint in the arc. A comparison with large-scale photographs of the sun-spot spectrum shows a wide magnetic separation for many of the low-temperature scandium lines which are strengthened in the spot.

ARTHUR S. KING.

FURTHER OBSERVATIONS ON THE FURNACE ABSORPTION-SPECTRUM OF IRON

In a recent study (*Astrophysical Journal*, **51**, 13, 1920) of the characteristics of absorption spectra produced by a furnace tube containing a diaphragm of graphite, it was noted that in the iron spectrum no absorption lines appeared of greater wave-length than $\lambda 5507$. The furnace was operated in a partial vacuum, the graphite plug showing a temperature of 2600° C. The iron lines farther to the red are less subject to self-reversal in laboratory sources, and it was predicted that a still higher temperature would bring out the absorption spectrum of this region also.